NEWSLETTER

JANUARY 1983

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FIRE BLIGHT

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INTERNATIONAL WORKING GROUP

ON FIRE BLIGHT RESEARCH

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ON

FIRE BLIGHT RESEARCH

NEWSLETTER

from the

Plant Protection Commission

International Society for Horticultural Science

in cooperation with

U.S. Deciduous Tree Fruit Disease Workers

and

European & Mediterranean Plant Protection Organization

JANUARY 1983

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Service

Appalachian Fruit Research Station
Kearneysville, West Virginia, USA

Letter from the Editor

Another year has passed and fire blight has been on a rampage in several locations, indicative from the numerous reports received from around the world. At the same time, I feel that fire blight scientists are slowly but surely closing in on learning more about the nature of existence and survival of Erwinia amylovora as a microorganism and now this relates to the state of the host plant in conjunction with environmental conditions in the overall fire blight syndrome. I am sure there will be much discussion on this subject at the upcoming Fire Blight Workshop in Bordeaux this September.

During 1982, the Peoples Republic of China has joined our list of countries showing an interest in fire blight. The contact person, Mr. Rubin-Cao at the Zenjiang Agricultural University in Hangznou has reported that, based on current knowledge to date (see page 9), China must be considered free of fire blight. So, combined with previous reports of the absence of fire blight in Japan and rare or very sporadic occurrences of the disease in New Zealand, Chili, Guatemala, and Mexico, fire blight can be considered a major disease of economic importance only in North America and Western Europe.

Even though every Newsletter seems to carry a considerable amount of new information, I am rather disappointed in the poor response to the annual questionnaire sent out to 50 contact persons. At best, about 50% of the questionnaires are returned and many of these are very hastily and thus poorly filled out. Therefore, I urge all contact persons to make an extra effort to collect and report interesting material for our Newsletter. Especially those who are located in countries, states, or provinces with fire blight should be in touch with fire blight colleagues and be informed of new occurrences and research developments. At the same time, all persons receiving this Newsletter should be in touch and report interesting events to the contact person nearest to you. The quality of our Newsletter is only as good as the quality of the questionnaires that I receive.

Finally, the Ithaca and Geneva group of fire blight researchers would like to invite the fire blight workers of the world to come to upstate New York for a fire blight workshop in June, 1985, following the 6th International Conference on Phytopathogenic Bacteria in Beltsville, Maryland. This proposal will be presented at the Bordeaux meeting.

Tom van der Zwet

TOM VAN DER ZWET, Secretary
North American Section
International Working Group
on Fire Blight Research

ROLAND C. BLAKE

(1920 - 1982)

Roland C. Blake, USDA, Research Horticulturist and adjunct Associate Professor in the Department of Horticulture, Ohio Agricultural Research and Development Center, Wooster, Ohio, died on August 29, 1982, at the age of 62.

Born in Howland, Maine, Dr. Blake earned his BS degree in horticulture from the University of Maine in Orono and a PhD degree from the University of Minnesota in St. Paul. He joined the research faculty of Washington State College in 1954 and in 1957 became a research horticulturist for the U.S. Department of Agriculture in Medford, Oregon, specializing in pear breeding and culture. He conducted research at the Southwestern Oregon Branch Experiment Station until early 1959, when he was transferred to the USDA Small Fruit Research Center at Carbondale, Illinois.

In 1973, Dr. Blake was transferred to the Ohio Agricultural Research and Development Center in Wooster to conduct research in pear culture and to assist an extensive USDA-ARS pear breeding program with headquarters then in Beltsville, Maryland, and today at the Appalachian Fruit Research Station in Kearneysville, West Virginia. During the next 9 years, he was involved in all phases of the breeding program. His efforts resulted in the establishment of an extensive computer-based system of data editing and management. The culmination of his active career came just before his death when he became the corecipient with Drs. R. L. Bell, J. Janick, R. H. Zimmerman, and T. van der Zwet in the 1982 ASHS Stark Award for the research paper "Response of Pear to Inbreeding" in the Journal of ASHS, Vol. 106:584-589, September 1981.

THIRD

INTERNATIONAL WORKSHOP ON FIRE BLIGHT

SEPTEMBER 12-16, 1983

BORDEAUX, FRANCE

International Society for Horticultural Science

Plant Protection Commission

Although definite plans are not entirely firm now, we can provide you with the following information, which might help you with your travel arrangements.

The meeting will begin on Tuesday 13 in the morning at the INRA, Centre de Recherches de Bordeaux (see map). We expect that everybody will have registered on Monday 12. Tuesday and Wednesday will both be devoted to papers and discussions. On Thursday 15, we will make an excursion to the Dax Experimental Field (120 km south).

Friday 16 will be, at least partly, a recreative day with a tour in a vineyard area around Bordeaux. The tour will be wholly or partly free of charge for participants who registered. If you are willing to participate, do not plan to leave Bordeaux before Saturday 17.

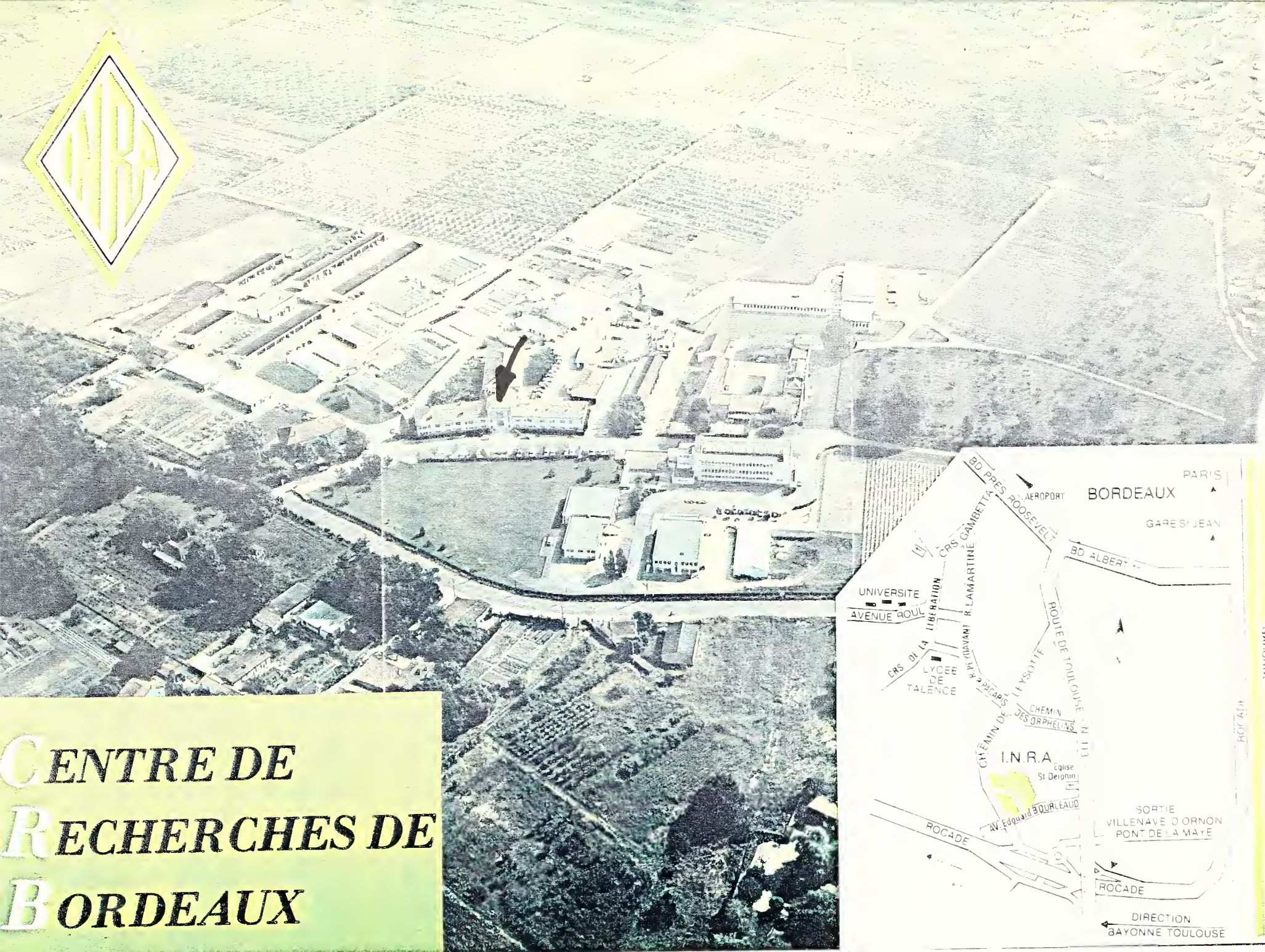
Preliminary reservations for accomodations for singles has been made at the dormitory of the University, for doubles in hotels downtown Bordeaux.

We have received now as many as 70 pre-registrations for this meeting, and propositions for more than 30 papers and/or posters.

The complete program will be established in May, when the contributions are confirmed: you will (or have already) received the 2nd announcment with the attached form dealing with papers or posters.

For more details, contact: Dr. J. P. Paulin, INRA, Station de Phytobacteriologie, Route de St. Clement, Beaucouze 49000 Angers.
(Phone 41 - 48.51.23)

CENTRE DE RECHERCHES DE BORDEAUX



PRESENT STATUS AND NEW OCCURRENCES OF FIRE BLIGHT

FRANCE

1982 has been a very "active" year for fire blight in France:

- Further spread of the Northern focus (South and East, 50 km).
- In the South West area, spread Eastward (Agen) and North: few cases in Vallée du lot).
- New detection in a new area: Strasbourg, where bushes of Cotoneaster and Pyracantha have been found contaminated, probably from the nearby German foci. A survey (Plant Protection Service) showed that the disease is presently restricted to the town area (public and private gardens).

An unusual point this year (1982) is the importance of the disease on unusual (for us) host plants:

- apples in the North area ('Idared', 'James Grieve', 'Jonagold', 'Karming', . . .).
- Cotoneaster, Pyracantha (South West) and pear varieties which were less susceptible the previous years: 'Duc de Bordeaux', 'Williams', 'Guyot', 'Doyenne du Comice', 'Beurre Hardy'. The 'Passe Crassane' variety has been less severely infected, due to a poor summer blossoming.

Climate is likely to be responsible for this change in the attacked host plants: very dry during first bloom, warm and wet in May-June when several pear varieties were showing secondary blossom, and when ornamentals were in full bloom.

J. P. Paulin
Beaucouze (Angers)

NETHERLANDS

During the blossoming period of pears in 1982, the weather for fire blight infection was unfavorable. By a rise in temperature plus rain in the second half of May and the first half of June, however, the circumstances for infection became very favorable during the blossoming time of apples, Crateagus and some Cotoneaster species.

During that period also some hailstorms occurred in several regions of the country. As a result, heavy blossom infection was observed on the three host plants mentioned as well as shoot infection in pears, mainly in the old foci in the southwestern and southeastern parts of the country. Though hail later in the year caused some fruit infections in apples and pears, the lower temperature during the second half of June and warm, dry weather during July and August saved the country from an epiphytotic. Under these unfavorable circumstances for the disease, many shoot infections secluded themselves, saving the trees from being killed.

C. A. R. Meijneke &
H. P. Maas Geesteranus
Wageningen

ENGLAND

Across southern England and the Midland, fire blight was more common and severe than usual on most hosts. Hawthorns infected in 1981 were a major source of inoculum for other hosts. Apple blossom blight was common, especially on some late flowering cultivars, including cider apples.

Although fire blight is now more widespread, it is by no means universal on susceptible hosts.

Weather analyses reflected well the course of events and early warnings made possible by this were amply justified. Key weather features were: warm weather with rain in mid-May and early June and warm, wet weather with storms in late June.

Eve Billing
East Malling

SHOWERINGS, VINE PRODUCTS & WHITEWAYS LIMITED
Fruit Production Division, West Newton, Nr. Bridgwater, Somerset TA7 0BZ.

Parts of correspondence between Mr. G. R. Rowsen and Dr. T. van der Zwet:

10 August, 1981

"For the last 23 years, this company has been growing, on its own farms, some 420 acres of perry pears and these have been contributing to our total requirements of fruit for our fermented perry, trade named 'Babycham'.

We first had an outbreak of fire blight in 1978 and since then have had to grub out some 80 acres, chiefly of the two most susceptible varieties, 'Barnet' and 'Judge Amenlett', (all of our varieties are, incidently, the old traditional English perry pears which have been around for 200/300 years or more).

We recently discovered two trees of 'Old Home' at the Long Ashton Research Station which, thankfully, seems to be resistant to fire blight and we expect to propagate some 3000 this summer by budding on to seedling pear stocks. I am hoping to get a small number of buds of a few resistant seedlings from Dr. Frank Alston at East Malling Research Station and have written to Mr. Lyle Brooks of Forest Grove, Oregon, as some of his hybrids are also in the vicinity of East Malling.

We have tested 'Old Home' for its juice properties and find that it is perfectly acceptable for our process but these new seeldings have yet to be brought to the fruiting stage.

We are looking for pears which have a moderately high acid and tannin content but, in the absence of the tannin, I expect we could do with what is no more than a culinary pear rather than a sweet dessert one".

13 December, 1982

"Fire blight has been very severe during the past summer in cider apples, but not so in perry pears. Fortunately, during April when the pears were in bloom the weather tended to be cool and dry and so we did not have the optimum conditions for an initial spread of infection from hold-over cankers. The pear blossom also was pretty scarce, which no doubt helped.

During the latter part of May, however, and into early June, just as the cider apples were in flower, or coming on in the case of late-flowering varieties, the temperature went very high (up to 26.1° C) and we had a period of thunderstorms and torrential rain. As a result, there was a massive explosion of fire blight in the varieties 'Chisel Jersey', 'Vilberie' and 'Brown Snout' (all late flowering) but also some in late-mid season flowerers, such as 'Yarlington Mill' and 'Brekwell's Seedling'.

Ornamental shrubs and small trees, especially Cotoneaster spp and Sorbus aria were much affected in private gardens and parks departments land, and the indigenous hawthorn which makes up so much of English farm hedgerows, was also very severly affected.

The incidence in cider apples was most severe in the southwestern counties of Somerset and Dorset, although there were cases in Avon (Bristol area) and Devon.

The major cider growing area of England is in Herefordshire and Worcestershire, but there the disease only showed for the first time in 1982, and so the level of overwintering inoculum from 1981 was obviously not high enough to give a massive outbreak.

It is significant that, in our own Company orchards, the degree of severity of outbreak exactly follows the heavy blossom production in an 'on' year: most of our cultivars are now heavily biennial and '78, '80 and '82 have all been 'on' years.

Following the major grubbings (in 1978-81) of our own most susceptible perry pear varieties on 4 out of our 5 pear orchard locations, we hoped for a respite this past year - and got it.

The only grubbings we had to do were of isolated trees as opposed to whole blocks and we finished the season with no more than 300-400 trees removed in total.

Unfortunately, the biggest proportion of these came from the one farm orchard which had, up to now, remained virtually free despite having susceptible varieties, and no doubt we shall see the same serious outbreak on this farm in the next two-three years as we have had elsewhere previously.

The perry pear varieties we grow are the following and I have indicated their fire blight susceptibility on a 0-5 scale (0 = no fire blight), so far as we know at present.

EARLY HARVESTING

*	'Thorn'	1
*	'Judge Amphlett'	5 (all now grubbed)
*	'Taynton Squash'	1
*	'Moorcroft'	3
	'Theilersbirne' (Swiss Origin)	(not noted)
*	'Hellen's Early'	0-1

MAINCROP

*	'Hendre Huffcap'	3
*	'Red Pear'	2
*	'Barnett'	5
*	'Winnal's Longcon'	4
	'Newbridge'	4
	'Oldfield'	(not noted)

* Indicates a major acreage variety.

MAINCROP (continued)

	'Rock'	(not noted)
	'Yellow Huffcap'	1
	'Brandy'	1
	'Green Horse'	2
	'Pine'	(not noted)
	'Red Longdon'	(not noted)
	'Brown Bess'	2
	'Gin'	4
	'Wasserbirne' (Swiss origin)	(not noted)
	'Blakeney Red'	5

LATE HARVESTING

*	'Butt'	1

Eve Billing still gives us considerable help and advice and we have now conducted spray trials in conjunction with our Ministry of Agriculture for a second season, inconclusively, and will be completing them in 1983 - with or without a positive result."

WEST GERMANY

Letter to Dr. van der Zwet: 2 October, 1981

"All places where fire blight has been observed in SW Germany so far are located in the Rhine Valley between Kreis Freiburg in the south and the area Heidelberg - Mannheim in the north. The disease occurred mainly on Cotoneaster salicifolius floccosus, but also on:

Cotoneaster salicifolius 'Parkteppich'

Cotoneaster watereri 'Herbstfeuer'

Cotoneaster watereri 'Cornubia'

Cotoneaster dammeri 'Coral Beauty'

Stranvaesia davidiana

Pyracantha coccinea

Chaenomeles japonica

Malus adstringens

Crataegus x lavallei 'Carriereri'

In Kreis Lahr (north of Freiburg), two orchards of about 20 hectare size were infected. The pear and apple cultivars planted in those plantations were classified according to severity of infections into the following groups:

	Pear	Apple
Very Susceptible	'Conference' 'Bristol Cross' 'Williams Christ (yellow)' 'Kaiser Alexander'	'Klarapfel' 'Gloster' 'James Grive' 'Jonathan' 'Alkmene'
Susceptible	'Alexander Lucas' 'Williams Christ' (red)	'Boskoop' 'Jonagold' 'Signe Tillisch' 'Oldenburger' 'Brettacher' 'McIntosh'
Less Susceptible	'Gute Luise' 'Morestini' 'Clapps Liebling' 'Bunte Juli'	'Cox Orange' 'Golden Delicious' 'Idared' 'Maigold' 'Ontario' 'Gravensteiner' 'Glockenapfel'

The infection in these two orchards was so severe that so far, about 100 trees of cvs 'Bristol Cross', 'Conference', and 'Williams Christ' had to be rooted out. The other trees were cut back".

Prof. Grossman
Univ. Hohenheim
Stuttgart

In 1982, there was only little fire blight in southern Germany. Infections occurred on fruit trees as well as on ornamentals. No further spread of the disease was recorded.

E. Seemuller
Dossenheim

Generally, fire blight was not so severe in 1982 than in the year before. In the northern part of Germany, the disease is spreading mainly on the big leaved Cotoneaster species C. salicifolius and C. watereri. Only small infections could be found in fruit trees in the fruit area of 'Alte Land'. Hawthorn was heavily infected and is eradicated around 500m of nurseries and orchards.

W. Zeller
Heikendorf

BELGIUM

Extension of the disease in the non-protected areas of the country. Protected areas are foreseen; these are the areas where we find the nurseries: fruit trees as well as ornamentals. This is done for protecting the export possibilities. In these areas, we have epiphytic and symptomatological control of all host plants.

New areas of infection mentioned briefly in 1981: one in the Province of Liege (country of Vise) and one in the Province Brabant (the Hageland fruit area).

I can give you some more details on fire blight on apples. We observed in our orchard a serious infection on 'Golden Delicious' and 'Jonathan'. The infection was directly on the young shoots. We noted a very severe infection on a hedge of Crataegus around the orchard. In the same orchard, we observed infection on 'Gloster' and 'Jonagold'. In other cases, we observed only isolated infection on apple ('James Grieve'). Everywhere we had at the same time a serious source of infection. After cutting the infected branches, we did stop the extension once the source was disappeared.

W. Porreye
Sint Truiden

POLAND

In 1982, fire blight occurred at a very low intensity in the northern part of the country, mainly on apples and hawthorn. The weather conditions were very dry during almost all of the vegetation period.

P. Sobiczewski
Skierniewice

NEW ZEALAND

Very little fire blight observed anywhere in New Zealand in the past 12 months.

D. W. Dye
Auckland

SWITZERLAND

So far, no fire blight has been detected inside of Switzerland. Rigorous quarantine measures showed good results. An efficient inspection service for export nurseries has been set up. Wide information work was done.

In 1982, nearly 600 samples of suspected plants were tested for fire blight in the bacteriological laboratory.

The bactericide CGA 78039, developed for the control of fire blight, showed good efficacy against Agrobacterium tumefaciens.

R. Grimm
Wadenswil

ITALY

Up until now, no cases of fire blight have been found in Italy.

C. Bazzi
Bologna

SWEDEN

The annual research and investigation of fire blight (1982) didn't give any positive findings. So, the situation according to fire blight remains the same for Sweden as before.

Maria Graberg
Jonkoping

SPAIN

Fire blight has not been detected in Spain.

Cristina Noval Alonso
Madrid

GREECE

Fire blight has not been introduced in Greece.

P. G. Psallidas
Athens

HUNGARY

The disease is not present.

Z. Klement
Bucapest

NORWAY

As far as known, Norway is still free from fire blight.

H. Roed
AS-NLH

IRELAND

Fire blight has never been recorded in Ireland.

P. F. Walsh
Dublin

AUSTRALIA

Fire blight has not been detected in Australia and stringent plant quarantine measures apply, which are aimed at preventing its introduction.

D. N. Cartwright
Adelaide

CHINA (People's Republic)

Letter to Dr. van der Zwet: 10 August 1982

"I acknowledge receipt of the book Fire Blight which you sent recently and I want to thank you very much for that. I also received your slip of July 23, inquiring whether there is or has been any fire blight in mainland China. In answer to this question, I should say that up to the

present as far as I know, we have not encountered anything suggesting the presence of Erwinia amylovora. I enclose here in two check lists of bacterial plant pathogens in China - one by T. F. Yu and C. T. Fang (1956) and one by C. T. Fang and X. Z. Ren. (see XII-E-6 and 7) In the first paper, the authors emphatically stated that their isolations of bacterial cultures from the principal pear growing areas in north China in no way show characters of Erwinia amylovora. In the second paper, Fang and Ren do not even mention E. amylovora in the list. Thus, so far we have not had evidence of the presence of this bacterium in our country".

Ruo-bin Cao
Zhejiang Agric. Univ.
Hangzhou

ONTARIO

1982 was a light year with regard to fire blight infection. This blight infection was favored by warm dry weather in the spring of the year. On the other hand, 1981 was a particularly bad year for fire blight, causing much damage on susceptible apples in the SW portion of the province. In recent years, fire blight has been more prevalent on apples. There has been a reduction in pear acreage and growers tend to reduce nutrition of the trees hoping to avoid fire blight.

W. G. Bonn
Harrow

ALBERTA

Severe in Edmonton (pop. 600,000) and several smaller cities in central Alberta on European Mountain Ash. Hundreds of 5-20-year-old trees, vigorous and healthy in previous years, killed or severely damaged (count could be in thousands). Similar outbreak occurred in 1974 on European Mountain Ash. Disease did not show up until mid-July and continued into September (very dry, drought conditions in Edmonton from April to July 1). Very light damage on apples, crabapples and pears. "American" types of mountain ash were not damaged significantly. Why only the European Mountain Ash? It seems to occur in cycles.

I. R. Evans
Edmonton

UNITED STATES

WASHINGTON

While most of the pears growing in Washington are found in the semi-arid regions east of the Cascades, the weather conditions that they are exposed to during any given year vary tremendously from district to district. If we consider just the Wenatchee fruit growing area, pears are grown from 500 to 1500 feet above sea level. Thus, within a five-mile radius, 'Bartletts' full bloom may be three to four weeks different. As we go 20 miles up the Wenatchee River into the mountains, total precipitation increases from about 9 inches to 18 inches a year, but average daily temperature decreases. Since each of these factors influence fire blight development, in Washington it is difficult to generalize on the fire blight situation during any given year. However, 1982 was a bad fire blight year in many respects.

In the Omak-Okanogan fruit growing area, a severe hail storm hit about a month before 'Anjou' harvest. Up to this time, no fire blight had been observed in the district. Within a week, fire blight was very prevalent in most of the hailed-on orchards. In most cases the infection appeared to be confined to the fruit. It is frequently observed in Washington that when fruit infection occurs shortly before harvest, the fire blight is confined to the fruit and fruiting spurs. Some of the growers who had fire blight resulting from the hail storm successfully controlled spread by merely breaking off the spurs on which the infected fruit was growing.

In the Entiat-Wenatchee-Wenatchee River pear region, fire blight was severe in many orchards. However, a number of orchards that have had a recent history of the disease were comparatively blight free. There was a fairly heavy second bloom on 'Bartlett', but the weather was cool and no blossom blight developed. By mid-June, however, severe shoot infection was common throughout most orchards. Fire blight was as prevalent on 'Anjou' as on 'Bartlett'. I believe that this epidemic was directly related to the unusually high aphid population in many orchards.

Historically, fire blight is more common in the lower Yakima valley than in other fruit growing regions of the state. This is probably due to its slightly higher spring temperatures and the fact that most of the pears in the district are 'Bartletts'. Some fire blight was observed throughout the valley from late spring on. However, the condition did not become severe until about harvest and then increased until the trees went dormant. Prior to the time when winter pruning was begun there appeared to be three or more strikes per tree in most orchards. One

unusual case was called to my attention. A grower was using over-tree sprinklers for frost protection. Many of his valves were faulty and the sprinklers, which were in the center of some trees, leaked. He also had failed to remove many active cankers from the tops of the trees. Most of the lower blossoms blighted in trees with both cankers and sprinklers. Since the sprinklers were only under pressure on days when frost had occurred, the 60° F mean, which is thought to be critical for blight development in Washington, was not met. It appears that the high levels of initial inoculum reduced the number of hours above 57° that was required for infection to occur.

R. P.Covey
Wenatchee

MARYLAND

Almost no blossom blight in Maryland in 1982 and, except where hail struck in June, only moderate amounts of shoot blight.

One 'Rome' orchard in Washington County which has been severely affected by fire blight for 3 consecutive years prior to 1982, survived this year with only an occasional strike. The grower used an 8-8-100 Bordeaux mix at silver tip, then followed with streptomycin 17% SP (6 oz/100 gal) in each of 6 sprays through first cover. The grower also maintained a 7-10 day interval between the first 3 cover sprays using azinphosmetnyl for leafhopper control.

A block of 'Summer Rambo' apples that had only modest amounts of fire blight in the past, showed none this year until just after a severe hail storm when hundreds of strikes developed on each tree. Between hail damage and fire blight, the 'Rambo' crop in that orchard was a total loss in 1982.

P. W. Steiner
College Park

DELAWARE

Average fire blight year in Delaware.

S. H. Davidson
Wilmington

MICHIGAN

Fire blight was not serious in Michigan in 1982. Streptomycin sprays gave excellent control, partly due to a late and short bloom period.

E. J. Kos
East Lansing

CALIFORNIA

1982 was a year in which blight was controlled well in the Sacramento Valley. With extremely poor economic conditions in the pear industry, however, several orchards were abandoned and blight was seen to have been potentially a severe problem in its uncontrolled state.

It was a relatively short season for blight in the Sacramento Valley as abnormally cool weather during the main and second blooms resulted in control programs being started later than usual. Most blight developed late in spring on rattail blooms during rainless, but humid weather.

In the Lake County area, where blight is often controlled more easily than in the humid Sacramento Valley (and where, consequently, growers frequently gamble successfully in withholding blight controls), blight was the worst encountered in decades in several untreated orchards which received late season hail. Outside the hail belt, blight was well controlled in this area. It was interesting that within the hail area, results of control showed that growers had no chance to control blight resulting from the hail unless they had controlled strikes from earlier infection periods.

B. Zoller
Yuba City

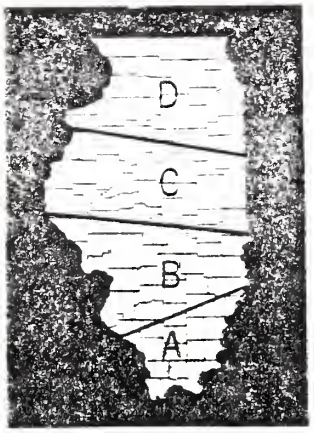
UTAH

Fire blight occasionally serious on apples; very erratic occurrence. No fire blight on pears.

S. V. Thomson
Logan

ILLINOIS

Unusually severe in 1982 with many trees on susceptible rootstocks (M-26 and M-9) being killed due to rootstock invasion. (see also V-41)



Illinois Spray Service Report, May 26, 1982

Fire Blight

This disease is being reported for several different orchards in Areas A, B, and C. Most probably it will appear in Area D on about Memorial Day. Some blocks of susceptible cultivars are uniformly infected and growers are quite understandably upset. They most frequently ask two questions. The first commonly concerns why they have blight in their orchards in 1982. The answer had eluded scientists for nearly 100 years. Dr. Dwight Powell in Illinois and Dr. Eve Billing in England devoted significant portions of their careers to answering this question. Both agreed that climactic conditions prior to bloom were critical to the development of the disease. Dr. Powell developed a predictive model for blight severity based on temperatures after the last spring frost. The model proposed by Dr. Powell would have predicted 1982 as a very severe blight year in most areas of Illinois. Dr. Billing's model is also based on climate and also would have predicted severe blight. Therefore, many growers have blight and have lost significant percentages of their 1982 and most probably their 1983 crops.

Their second question concerning fire blight is "what can I do to stop the spread and devastation?" The answer to that question is quite easy - Nothing! Continued streptomycin sprays after bloom and after the appearance of secondary "strikes" on succulent shoot tips is legal but is not considered worthwhile. The disease will spread with each wind-driven rain storm and will not stop spreading until terminal buds form and hot dry July weather occurs. Many growers have attempted to stop the movement of blight in their orchards by removing the infected shoots by pruning or by more radical measures like burning it out with a blow torch. The pruning technique generally is not practical and stimulates additional succulent growth which immediately blights. The blow torch technique has been tried by some northern growers and will kill blight bacteria without stimulating new growth but it is not considered practical in terms of time and manpower. There has been some talk by growers of trying a weak bordeaux solution on infected trees. Growers in California use bordeaux to control blight on pears. Generally, such a spray is not recommended in the midwest because bordeaux is phytotoxic, causes fruit russet, and is not considered very efficacious.

The "bottom line" is to try again next year by employing all known control measures. These include pruning, to remove blight, balanced fertility, and a vigorous streptomycin spray program.

S. M. Ries
Urbana

WEST VIRGINIA

In general, fire blight was not a problem in 1982. It was interesting in 1981 that in one 'Winesap' - 'Jonathan' apple orchard, fire blight occurred on trees located in a low spot where trees had also suffered from spring frost injury, whereas no blight occurred on similar trees located on high ground nearby (no frost damage).

In an experimental 'Rome' apple orchard (topped trees with numerous succulent shoots) at the WV Experiment Farm, few blight strikes occurred prior to August 15. Some time during September, many, many new infections occurred (persumably aphid involvement) and by early October the orchard looked exactly as if a helicopter with a blow torch had flown across the tops.

J. G. Barrat
Kearneysville

NEW YORK

Fire blight occurred sporadically in New York State in 1982. Many orchards sustained only a few infections. However, several orchards in both the Hudson Valley and Western New York fruit growing areas sustained severe infection.

S. V. Beer
Ithaca

DETAILS ON CURRENT FIRE BLIGHT RESEARCH

REPORTED FROM SOME UNIVERSITIES AND EXPERIMENT STATIONS

FRANCE

Plant Pathology Angers (INRA)

Study of the influence of the experimental sprays of streptomycin on bacteria on leaf surfaces (epiphytic bacteria and E. amylovora): resistance to streptomycin and other antibiotics...plasmids...etc. (coll. with L. Gardan).

- climate and fire blight in France (coll. with National Met. Office)
- chemical control
- participation in breeding and susceptibility program (Pear, Apple, Cnam.)

Plant Breeding Angers (INRA)

- physiology of summer blossom of pear
- breeding for resistant Pyracantha
- Apple and Pear breeding for resistance to fire blight

J. P. Paulin
Sta. Path. Veg.

NETHERLANDS

Warning and Forecasting

Research into the usefulness of the system Billing as a base for a warning system for the timing of sprays in fruitgrowing went on. Theoretically, it must be possible to use it in this way and by doing so to prevent much damage from the disease by spraying only a few times per season at adequate times. Of importance is the availability of non-phytotoxic compounds for use during the growing season. Copper compounds are usually too phytotoxic under Dutch circumstances. Next steps in this research will have to be field trials to prove the practical worth of the theory and the writing of a computer program for a number of field stations to do the necessary calculating work in time and without man-made faults. The computer can then give the advice to spray or not to spray, which advice can be passed on to the fruit growers by telephone or computer systems.

A second point of research will be to check the value of autumn sprays on host plants in nurseries in order to give nursery material more guarantee of freedom of infection (epiphytic or endophytic) than can be provided by field inspection alone.

C. A. R. Meijneke
Plant Prot. Service

Chemical Control

The efficacy of one spray against artificial inoculation with E. amylovora of Kasumin (kasugamycin), CGA 78039 (experimental bactericide), Plantomycin (streptomycin) and Koper Bayer (copper-oxychloride) were tested on flowering Cotoneaster dammeri 'Corral Beauty'. In preventive trials, using inoculum densities of 10^6 and 10^8 cells/ml, the products were equally active.

In curative tests, Kasumin, CGA 78039, and Plantomycin were equally active at the 10^6 cells/ml inoculum level; at 10^8 cells/ml, CGA 78039 and Plantomycin were less effective than Kasumin.

Plantomycin, frequently sprayed against natural infections on 'Conference' pear gave significant reduction of infection. Plantomycin, CGA 78039, Kasumin and Koper Bayer were equally effective against natural infection on Cotoneaster dammeri 'Coral Beauty', frequently and non-frequently sprayed. The data obtained on weather, phenology of the crops, infection, and treatment are prepared in view of the usefulness of the Billing System.

T. Kooistra
Plant Prot. Serv.

Epidemiology

Considerable numbers of pear seedlings of the French and Italian breeding programs were screened on the degree of susceptibility to E. amylovora, as well as Crataegus seedlings from seeds obtained from botanical gardens all over the world.

An observation field in a contaminated area was planted with the Dutch collections of Pyracantha, Cotoneaster, Crataegus, and Sorbus to demonstrate the degree of susceptibility to blossom infection under natural conditions. Contamination experiments demonstrated that the pathogen did not survive the winter period in buds of apple and pear

trees. Microinfections did not develop after various ways of bud scale inoculations. The pathogen survived longer in the leafscars of apple, but did not penetrate deeper into the twig tissue. The bacterial population decreased in the leafscars during the winter months and could no longer be isolated at the end of February. Inoculations in November did not result in symptom development, neither in winter nor in spring. Spraying copper compounds during the period of leaf fall may prevent a leaf scar infection.

Epiphytic bacteria present on pear leaves in a contaminated orchard, did not survive a period of 2 days, when the branches were transported to a pathogen-free area. It is suggested that in an orchard, where the pathogen can be isolated from the leaf surface at any time, there must be a constant migration of E. amylovora bacteria originating from upwind oozing cankers.

H. P. Maas Geesteranus
Res. Inst. Plant. Prot.

ENGLAND

Billing's work assessment systems are being further developed for use in England and are under study in an EEC exercise.

Spray trials are in progress in southwest England in laboratory experiments; the addition of galactose to the medium induced some non-capsulated mutants of Erwinia amylovora to produce capsules and extracellular polysaccharide.

Eve Billing
East Mall. Res. Sta.

WEST GERMANY

Research with the new chemical compound CGA 78039 was continued. Protective sprayings after artificial inoculation of the highly susceptible ornamental host Cotoneaster salicifolius floccosus in blossoms showed good results (up to 95% efficiency).

Breeding for resistance in the highly susceptible Cotoneaster species C. salicifolius and C. watereri were undertaken in 1982, together with the nursery industry. With a further assortment of native pomefruit varieties, resistance studies will be continued on a new testplot near Bornhöved in Schleswig-Holstein.

W. Zeller
Biol. Bundesanstalt

BELGIUM

Research on chemical control with several new compounds (flumedin, kasugamycin, etc.) is being continued.

W. Porreye
Opzoek. Sta. van Gorsem

SWITZERLAND

Budwood of the following 64 pear varieties were sent to the USDA Plant Quarantine Service at Glenn Dale, Md., where Dr. van der Zwet will inoculate the young trees and rate them on their degree of blight resistance. The information should be available in the next newsletter, and should be important to pear breeding programs.

Allinges
Barberon
Bellossin
Bergamotte de Ballaigues
Bergbirne
Blesson a longue queue
Blesson Marioz
Bühlmättler
Carizi
Catillac
Cent grappes blanc
Cent grappes rouge
Channe vaudoise
Channe Prangins
Collonges
Couela
Culotte suisse
Culotte de Versvey
Eierbirne
Epine d'ete
Fossati
Gaucher
Gelbmöstler
Goldbirne 1
Goldschmeckeler
Grise Corsinge
Grünmöstler
Güntershauser
Hanslibirne
Junibirne
Juteuse de Chailly
Knollbirne
La Fribourgeoise
Martin sec
Marxenbirne
Petolin
Poire Caluet
" Channe
" de Fiez
" farine
" guepe
" Mandrin
" Monnetier
" muscat
" pate
Puttapi
Rondi
Roussett
Sanguinole
Schellerbirne
Schweizer Bratbirne
" Wasserbirne
Schürbirne
Sous Vanel
Soitzbirne
Tabatiere
Theilersbirne
Triacca
Vaux de Viney 5
Verte de Dully
Wettingerbirne
Wildling von Einsiedeln
Zuckerbirne

R. Grimm
Eidgen. Forschungsanstalt

ITALY

Current work at the Phytobacteriology Laboratory:

a) Weather analyses, with Billing's Spring System, in relation to the potential risk of fire blight outbreaks in some Italian fruit growing areas.

b) Improve diagnostic methods for a rapid identification of the pathogen.

C. Bazzi
Lab. Fitobatterriol.

POLAND

1. Study on forecasting of fire blight using the system of Billing.
2. Evaluation of various chemicals for control of fire blight.
3. Laboratory and greehouse testing of plant material coming from abroad for presence of Erwinia amylovora.

P. Sobiczewski
Res. Inst. Pomol.

NEW ZEALAND

No fire blight project now current. Fire blight is now a very low priority project in New Zealand.

D. W. Dye
Plant Dis. Div.

UNITED STATES & CANADA

WASHINGTON

An attempt was made at biological control of fire blight using strains of Erwinia herbicola (rif. 50 ppm) obtained from Dr. Steve Beer. The E. herbicola was sprayed on 'Bartlett' at one-quarter bloom and full bloom. Twenty-four hours following the last application of E. herbicola, the trees were spray-inoculated with E. amylovora. Checks as well as a Streptomycin (60 ppm) treatment were included in the trial. The population of both bacterial species was monitored following application.

Three of the five E. herbicola strains appeared to establish themselves in the orchard. Each of these three strains reduced the population of E. amylovora. None of the strains was as effective in reducing the population of E. amylovora as was streptomycin. Approximately five weeks after full bloom, fire blight was noted on all inoculated trees. There were no differences between treatments except that no infections were noted on the noninoculated checks. Counts of 100-200 infections per tree were recorded. None of the infections appeared to have originated in spurs. Whether the disease could have been controlled by a continued spray program remains to be answered.

CALIFORNIA

Excerpts of correspondence with T. van der Zwet:

"I am enclosing examples of three in-house publications which we use to prepare growers each year for the blight season:

1. Fire Blight Control in California by Numbers - March 10, 1977. While we have accumulated six more years weather data, field observations and in some cases monitoring data, the treatment guidelines as described on this date in 1977 have survived intact and have not been updated. The guidelines are based on the population data of Figure 1 which shows that populations asymptotically approach zero at 65° F (18.3° C). Since the curve is an asymptote, this is support for Billings' growth below 18.3° C. The data of Figure 1 are the same ones included in the abstract (Phytopathology 69:1050, 1979). The curve, Figure 1, was also published in Ore. Hort. Soc. Ann. Rept. 69:57-71, 1978.

2. Fire Blight Control - April 1, 1981. This publication is annual and serves to remind our clients that the time is near and what they should have done last year so that forgotten principles can be reinstituted. It also compares field observations, any population data and weather system data (simultaneous higher temperatures and temperatures and humidity, mean temperatures and degree hours) for three districts each year.

3. Fire Blight Monitoring - Spring, 1982. This series of weekly reports sent each blight year supplements phone calls, and documents what the weather system is predicting will happen and when, as well as what is happening in the field. Generally the growers don't really see much blight until sometime after we stop sending the weekly report. The weekly report only serves to document when it occurred according to the system and when we in the field started seeing it. This proves invaluable in discussing any problems with blight seen by growers later.

All of the above only serves to describe how we operate, and I know doesn't really quite answer the question Billings vs. degree hours very well. We do have complete maximum temperature data to go with the population data. At the time we were monitoring and through the present, however, our feeling is that maximum temperature can be used as a prediction scheme, in general, but is subject to the same short comings as mean temperature systems.

In the absence of control treatments with "morning after" eradicative properties such as are available in pear scab control, this sytem is probably more valuable in predicting what the bacteria and disease epidemic are doing, than in scheduling each and every treatment. Experience has shown that we're unable to predict the occurrence (and sometimes we're unable to accurately measure the occurrence) of periods of high simultaneous temperature and humidity far enough in advance to enable treatment of entire acreages in the time allotted. For this reason, you're once again encouraged to adopt an interval schedule of treatments once the accumulation of 150 degree hours predicts the bacteria will begin to be spread beyond the locus of holdovers and other infections.

If you've a history of blight difficulties or are in a high risk blight area, such as the Upper Sacramento Valley or Sloughhouse areas, a three day interval schedule is highly advisable. We prefer this approach in all areas; however, watching the weather can sometimes enable growers in the less blight-prone districts to lengthen this interval on occasion.

We have noted that in the Upper Sacramento district once each year in the last three years, the weather has become favorable for blight infection initiation almost daily during a period in which a major bloom was occurring and degree hours were accumulating to over 600. In two of these instances (March 17-31 in 1978, and April 10-17 in 1979), substantial numbers of new infections resulted in the blight-prone river bottoms, in spite of religious 3-day interval programs. Last year (April 13-20) every other day treatments were recommended and applied in this situation. Control seemed to be maintained, compared with other orchards in the district which suffered miserably from blight in 1980. This approach was also followed in the Delta District in 1980 (April 16-20) during a similar period of high degree hour accumulation, peak bloom, and weather continuously favorable for the initiation of infections. Will be watching for this development this season and will, if necessary, suggest extra treatments again."

Fire Blight in 1980, Revisited

"It is interesting that in 1980, some of the best blight control among our client growers was achieved in the most blight prone Upper Sacramento district which, in general, experienced the toughest blight weather in terms of highest degree hours, weather favoring infection occurring simultaneously, and blight actually occurring in other orchards. This shows that the treatments work and teaches that successful blight control is expecting that the worst will happen and doing something before it happens in a timely way.

Some of the worst blight control among our client orchards was achieved (?) in Lake County, which, compared with the other districts, had the least favorable blight conditions in terms of high degree hour accumulations coinciding with weather favorable for infection. Since blight weather was unusually favorable compared with the usual Lake County spring, however, many programs were too little and too late to control the blight the degree hour system predicted should occur. This shows that unsuccessful blight control is achieved when we expect the best to happen and the worst occurs.

Rather than discuss the daily specifics of blight last year for each district, we'd just like to point out on the enclosed weather records that most of the epidemic blight occurred in all districts during the April 13-20 period. Degree hour totals in all districts reached over 600, and relatively early in the season, meaning plenty of blooms were available for infection.

Judging from grower experiences last year, successful blight control required every other day treatments April 16-20 in the Delta and April 13-20 in the Upper Sacramento area. Successful blight control in Lake County required single treatments just prior to rainfall April 13 and April 20. For the most part since these rains began at night or early morning, the only treatments applied prior to these rains in Lake County occurred where growers had been following an interval schedule of treatments beginning April 12 as suggested by the system."

Broc Zoller
The Pear Doctor, Inc.
Yuba City

MISSOURI

The large molecular weight extracellular polysaccharide (EPS) of E. amylovora (amylovorin) 100,000,000 daltons has been depolymerized by two different E. amylovora bacteriophages to a polymer of 20-40,000 daltons. This fragment of amylovorin retains its wilt inducing activity without having the viscosity increasing effect (at 100 ug/ml) of the parent molecule.

It would appear that the fragment of amylovorin exerts its wilt inducing activity in a way other than visual occlusion. Ultrastructural examination of vessels in shoots exposed to amylovorin or high molecular weight dextrans, e.g., Dextran 2000 or Blue dextran 2000, revealed vessel occlusion at the base of treated shoots.

Presentation of data concerning the localization of E. amylovora in xylem vessels by a small positively charged protein, Malin, that probably belongs to a group of proteins with antibiotic activity known as thionins. The titer of these proteins in apple tissue is probably increased by exposure of tissues to the pathogen. ("Proteins in Plant Infection", a Conference at Wageningen, May 17-19, 1983).

A grant to study "Inducible Resistance in Apple Infected by Erwinia amylovora" was reviewed by N.S.F. for the period of 1983-1985.

R. N. Goodman
Univ. of Missouri

WEST VIRGINIA

Considerable emphasis is being placed upon the presence of epiphytic and endophytic E. amylovora on and in pear and apple tissues. Trees and limbs are being placed in insect-proof cages as part of monitoring research, rootstocks are budded with buds from trees with severe blight and blossoms, leaves, shoots, and fruit will be examined for epiphytic bacterial cells.

A detailed control experiment is in progress at the nearby West Virginia Experiment Farm, to test the effect of pruning, dormant, and/or seasonal sprays of streptomycin on fire blight in a 20-year-old 'Rome' apple orchard.

T. van der Zwet
USDA/AFRS

SOUTH CAROLINA

We are moving to the Billings system of fire blight prediction. Based on historical records, it looks good.

R. W. Miller
Clemson University

NEW YORK

At Cornell, a major project designed to develop a reliable prediction system for the occurrence of blossom blight (and the need for bloom sprays) was initiated in 1982.

New efforts are being initiated designed to understand the genetics and molecular biology of pathogenesis by Erwinia amylovora.

S. V. Beer
Cornell University

ONTARIO

The breeding program at Harrow will continue under the direction of Frank Kappel who was recently recruited to fill the position vacated by Harvey Quamme. Frank is currently completing a Ph.D. program at the University of Guelph.

The efficacy of CGA 78039 was found to be equal to that of streptomycin for control of fire blight of pear. Both blossom and shoot blight control was achieved through the use of this compound as a protectant.

W. G. Bonn
Harrow Res. Sta.

ALBERTA

No specific research projects.

Extensive fire blight damage has been observed in 1981, on crabapples, apples and raspberries (new canes) during prolonged dry or drought-like conditions in east-central Alberta.

The rose family is the major ornamental family in Alberta provincial emblem is the wild rose. Wild species in abundance: Pin cherry (Amelanchier), Choke cherry (Saskatoon), Strawberry, Raspberry, and Mountain ash. In past few years, fire blight has been isolated from: apple, crabapple, mountain ash, European cotoneaster, Amelonchier, Pear, Raspberry and rarely common hedge cotoneaster.

Royalty Crab (Centennial Crab) does not persist in most locations in Alberta after 5-10 years following purchase due to fire blight kill-off.

I. R. Evans
CDA, Pl. Ind. Div.

MISCELLANEOUS NEWS

FRANCE

A movie "Le Feu Bacterien" has been realized in 1982 by "Service Cinema du Ministere de l'Agriculture", 78 rue de Varenne -75007 PARIS (French version only). May be lent free of charge (in Europe at least).

From the same service: 2 cards with 30 microfilms (slides on tables) on fire blight can be obtained: 001: Fruit trees and 002: Ornamentals.

Gordon Bonn (Harrow, Ontario) will probably stay in my laboratory for 3 months this summer.

J. P. Paulin
INRA, Angers

CALIFORNIA

Spent two weeks in October in Chile viewing their rapidly expanding deciduous fruit for export industry. It doesn't seem fair, but I saw no blight in Chilean orchards. Biggest pathological problem seemed to be silver leaf in stone fruits.

Chile expects to be exporting 3 times the volume of fruit as South Africa in 2-3 years according to Pablo Cenoso, a private consultant in the Chilean fruit industry.

B. Zoller
Yuba City, Calif.

AUSTRALIA

The threat posed by fire blight to Australia's apple and pear industries was emphasized in a section dealing with bacterial disease of quarantine significance presented by Mr. S. J. Navaratnam, Department of Health, Canberra, A.C.T., during a workshop on "Bacterial Plant Pathogens" which was held in Brisbane on February 7-12, 1982.

D. N. Cartwright
Adelaide, S. Austr.

NEW ZEALAND

I will be retiring in December 1982 and Dr. C. N. Hale is taking over as head of the bacteriology section of Plant Disease Divsion. As of January 1, 1983, Dr. J. M. Young has taken over from me as Director of the Plant Disease Division Cultural Collection. Catalogues of holdings in the PDDCC are available on request.

D. W. Dye
Auckland, N.Z.

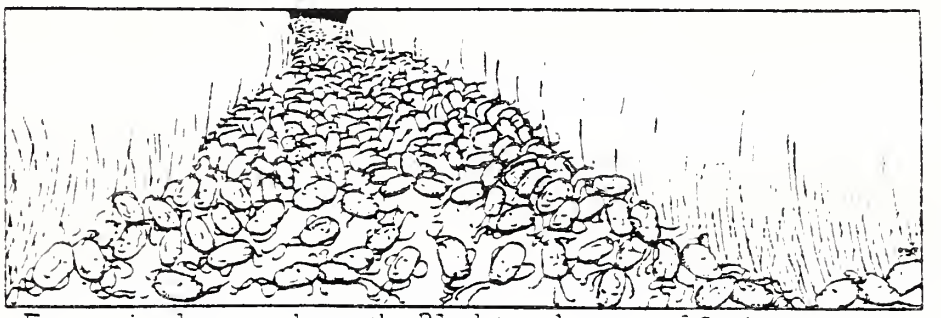
FUTURE MEETINGS

1983

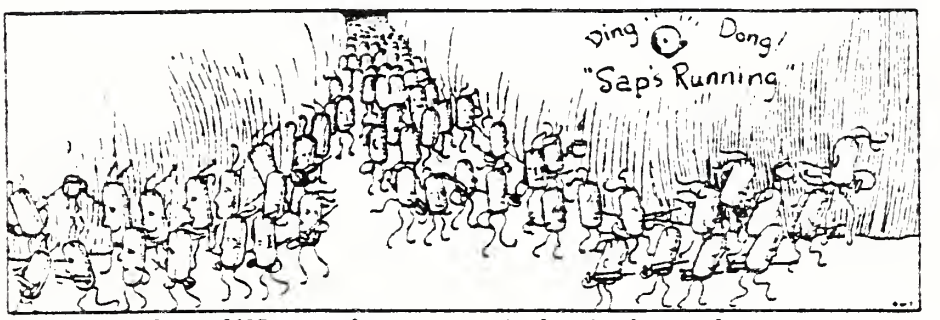
August 12-16 Third International Workshop on Fire Blight Research, INRA, Bordeaux, France. For further details, please contact: Dr. J. P. Paulin, INRA, Station Phytobacteriologie, Beaucouze 49000 Angers, France.

August 17-24 Fourth International Plant Pathology Congress, Melbourne, Australia. For details, write: P.O. Box 783, Canberra City, A.C.T. 2601, Australia.

November 20-25 Tenth International Congress Plant Protection Brighton, U.K. For details, contact: Mrs. R. A. Bishop, 144/150 London Road, Croydon, CRO 2TD, Surrey, UK.



Frozen in sleep, perhaps the Blighter dreams of Spring



After the fast of Winter they are ready for the feast of Spring

N. Y. (Cornell) Agric. Expt. Sta., Ext. Bul. 405, 32 pp., 1939

NEW THESES AND DISSERTATIONS ON FIRE BLIGHT

Hartung, John
"Purification of a capsular depolymerase from phage infected E. amylovora and cloning of the depolymerase gene." Ph.D. Dissert., Univ. of Michigan. (1983)

Ishimaru, Carol
"Purification, identification and possible mode of action of herbicolin C9-1, a bacterium-like molecule produced by E. herbicola strain C9-1." Ph.D. Dissert., Univ. of Michigan. (1983)

Sijam, Kamarugaman
"Comparative study of amylovorin and EPS produced by Erwinia amylovora." Ph.D. Dissert., Univ. of Missouri. (1982)

Baumm
"Development of a forecasting system for fire blight in the fruit tree area of the 'Alte Land' near Hamburg." Ph.D. Dissert., Univ. of Hamburg, West Germany.

Gasser, Max
"Valutazione dei dati meteorologici in Alto Adige in relazione ai rischi di comparsa del colpo di fuoco batterico (Erwinia amylovora)." M.S. Thesis, Univ. of Bologna, Italy.

Vanneste, Joel
"Etude de bacteriophages d'Erwinia amylovora." Maitrise, Faculte des Sciences, Angers, France.

Lenain, Marianne
"Les secondes floraisons chez le Poirier." Maitrise, Faculte des Sciences, Angers, France.

Leong, S. A.
"Iron assimilation systems of phytopathogenic bacteria. I. Production of siderophores by Agrobacterium tumefaciens, Erwinia carotovora, Pseudomonas phaseolicola, and Erwinia amylovora. II. Role of siderophores in the pathogenicity of Agrobacterium tumefaciens." Ph.D. Dissert. Univ. of California, Berkeley. (1981)

LOCATIONS REPORTING AVAILABILITY OF CULTURES OF ERWINIA AMYLOVORA FOR EXCHANGE PURPOSES (1980-1983)

Ithaca, N.Y. - Beer, S. V.

Urbana, Ill. - Ries, S. M.

Lyngby, DK - Jensen, A.

Kiel, WG - Schulz, F. A.

Harrow, Ont. - Bonn, W. G.

Heikendorf, WG - Zeller, W.

Wenatchee, Wash. - Covey, R. P. (Streptomycin susceptible and resistant strains)

Bologna, Italy - Bazzi, C. (Strain IPB-80 *A-1 = NCPPB 3059)[2]

Auckland, N. Z. - Young, J. M. (40 clusters, incl. type strain, from many hosts and many countries)

Edmonton, Alb. - Evans, I. R.

a. Plant Sciences, AEC, Vegeville, Alb. (Dr. P. Kharbanda)
b. AHRC, Brooks, Alb. (Dr. R. Howard)
c. Actual infected material (Dr. I. Evans)

Angers, France - Paulin, J. P.

a. Collection Nationale de Bacteries Phytopathogenes (R. Samson) 3eme edition du catalogue (1981): 900 strains (Phytopathogenic Bacteria) E. amylovora: 60 strains.

b. Serotheque (M. R. Barzic)
Soecific antisera against several phytopathogenic bacteria are avialable (lyophill). One of these is specific for E. amylovora. (slide agglutination test and Immunofluorescence). Charge: 400 FF (+ postage): Dose for 4 000 IF tests

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[2] NCPPB = Nat. Coll. of Plant Path. Bacteria, Harpenden, England.

FIRE BLIGHT LITERATURE RECEIVED DURING 1982

(Not Listed in USDA Agriculture Handbook 510,
the Additional Bibliography or Newsletter Jan. 1980, 1981 and 1982)

United States

II-A-31 Kent, C. H. 1870
Pear blight. American Agricul. 29(8):82.

III-204 Raymundo, A. K. and S. M. Ries. 1982.
Factors affecting motility of Erwinia amylovora. Proc. Fifth Intern. Conf. Plant Path. Bact. (Cali), pp. 308-322.

III-205 Beer, S. V. and J. L. Norelli. 1982.
Biological control of fire blight by Erwinia herbicola. Proc. Fifth Intern. Conf. Plant Path. Bact. (Cali), pp. 596-597.

III-206 Sijam, K., A. L. Karr, and R. N. Goodman. 1982.
Relationship of molecular weight and viscosity to wilt-inducing properties of Erwinia amylovora-EPS. Phytopathology 72:945.

III-207 Hartung, J. S, P. B. Rosenthal, D. W. Fulbright, and E. J. Klos. 1982.
Capsular depolymerase from bacteriophage infected Erwinia amylovora. Phytopathology 72:945.

III-208 Ishimaru, C., R. R. Brubaker, and E. J. Klos. 1982.
Characterization of a bacteriocin from Erwinia herbicola strain C9-1. Phytopath. 72:945-946.

III-209 Norelli, J. L. and H. S. Aldwinckle. 1982.
Variability in the virulence of Erwinia amylovora to apple cultivars. Phytopathology 72:1002.

III-210 Chatterjee, A. K., M. A. Brown, and J. S. Ziegle. 1981.
Isolation and characterization of a temperature sensitive mutant of a broad host range. Phytopathology 71:866.

III-211 Gantotti, B. V and S. V. Beer. 1982.
Plasmids of Erwinia herbicola influence pigmentation thiamin prototrophy and bacteriocin production. Phytopathology 72:260-261.

III-211a Gantotti, B. V. and S. V. Beer. 1982. Plasmid borne determinants of pigmentation and thiamine prototrophy in Erwinia herbicola. Jour. Bact. 151:1627-1629.

III-212 Thurn, K. K. and A. K. Chatterjee. 1982. Isolation and protein composition of the outer membrance of Erwinia amylovora. Curr. Microb. 7:87-92.

III-213 Bauer, D. W. and S. V. Beer. 1983. Evidence that the activity of a putative necrotoxin of Erwinia amylovora is due to the action of inorganic salts. Phytopathology 73:362. (Abstr.)

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VI-60 van der Zwet, T., R. L. Bell and H. F. Stroo. 1982. Long distance dissemination of Erwinia amylovora as resident bacteria in apparently healthy pear budwood. Phytopathology 62:711.

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VII-49 Beckman, J. S. and J. N. Siedow. 1982. The microbial activity of hydroquinone oxidation catalyzed by peroxidase. Phytopathology 72:935. (Abstr.)

IX-194 O'Reilly, H. H. and G. N. Morehead. 1968. Controlling fire blight of pear. Calif. Agric. Ext. Serv. Publ. AXT-264, 6 pp., illus.

IX-196a Anonymous. 1971.
Antibiotic sprays saves California pears from fire blight. Pfizer Scene (May) p. 11-12.

IX-246 Ellis, M. A. 1981.
Evaluation of a copper and oil dormant spray and streptomycin bloom sprays for control of fire blight in apple, 1980. Amer. Phytopath. Soc. Fung. and Nemat. Tests 36:4.

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Evaluation of compounds for control of apple fire blight during bloom, 1981. Amer. Phytopath. Soc. Fung. and Nemat. Tests 37:4.

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Treatment of fire blight of mountain ash with streptomcyin sulfate. Amer. Phytopath. Soc. Fung. and Nemat. Tests 37:138.

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Fire blight control on 'Jonathans'. Amer. Phytopath. Soc. Fung. and Nemat. Tests 38:133.

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Chemical control of fire blight of apple during bloom. Amer. Phytopath. Soc. Fung. and Nemat. Tests 38:147.

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Techniques for screening chemicals for fire blight control. Plant Dis. 66:1162-1165.

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Screening *Malus* species for fire blight resistance *in vitro*. HortScience 17(3):533. (Abstr.)

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Apple rootstocks breeding. Plant Breeding Reviews 1:294-394.

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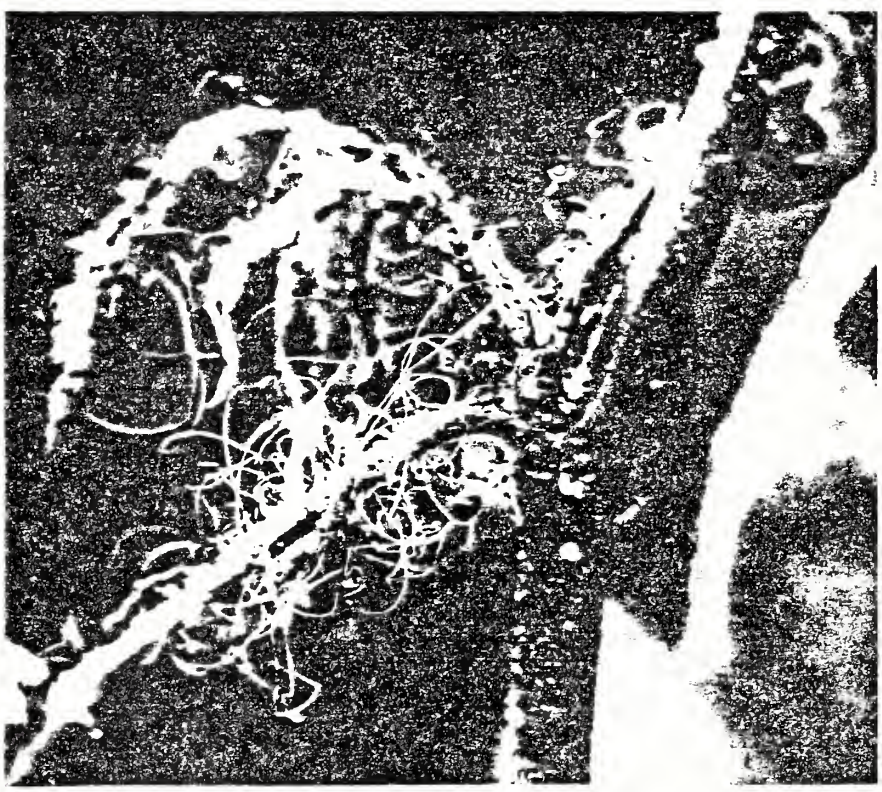

Bacterial Strands of Erwinia amylovora

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*Ellis, M. A.
French, J. R.
Gantotti, B. V.
Gates, D.
*Goodman, R. N.
Harnish, W.
Heimann, M. F.
*Hickey, K. D.
Hildebrand, E. M.
*Janick, J.
Johnson, D. E.
Jones, A. L.
Kado, C. I.
*Klos, E. J.
Koenigshof, R.
Kuc, J.
Kyle, N. E.
Lacy, G. H.
Lamb, R. C.
Landis, W. R.
Lombard, P. B.
Luepschen, N. S.
McSwan, I. C.
*Miller, R. W.
Morenead, G. W.
Morton, H. V.
Norelli, J. L.
Opgenorth, D. C.
Otterbacher, A.
Pecknold, P. C.
Preczewski, J. L.
*Preiser, F.
Rackham, R. L.
*Ries, S. M.
*Ritchie, D. F.
Rom, R. C.
Rosenberger, D. A.
Ryugo, K.
Sands, D. C.
Sasser, M.
Schroth, M. N.
Seem, R. C.
*Slack, D.
Spotts, R. P.
Starr, M. P.
*Steiner, P.
Stushnoff, C.
*Sugar, D.
Sutton, T. B.
Swanson, B. T.
Szkolnik, M.
*Thompson, J. M.
*Thomson, S. V.
Travis, J. A.
*Wade, E. K.
Way, R. D.
Westwood, M. N.
Willett, M.
Wodzinski, R. S.
Yoder, K. S.
Zehr, E. I.
*Zoller, R. G.
Zwet, T. van der

SUMMARY

Contact Persons for Fire Blight Newsletter

United States

Arkansas	Slack, D.
California	Zoller, B. G.
Delaware	Davidson, S. H.
Georgia	Thompson, J. M.
Illinois	Ries, S. M.
Indiana	Janick, J.
Maryland	Steiner, P.
Michigan	Klos, E. J.
Missouri	Goodman, R. N.
New Jersey	Preiser, F.
New York	Beer, S. V.
North Carolina	Ritchie, D. F.
Ohio	Ellis, M. A.
Oregon	Sugar, D.
Pennsylvania	Hickey, K. D.
South Carolina	Miller, R. W.
Utah	Thomson, S. V.
Virginia	Drake, C. R.
Washington	Covey, R. P.
West Virginia	Barrat, J. G.
Wisconsin	Wade, E. K.

Canada

Alberta	Evans, I. R.
British Columbia	McPhee, R.
Nova Scota	Ross, R. G.
Ontario	Bonn, W. G.

Other Countries

Argentina	Meyer, F. C.
Australia	Cartwright, D. N.
Belgium	Porreye, W.
China (P.R.)	Cao, R.
Czechoslovakia	Kudela, V.
Denmark	Dinesen, A.
England	Billing, E.
France	Paulin, J. P.
Germany (East)	Kleinhempel, H.
Germany (West)	Seemuller, E. Zeller, W.
Greece	Psallidas, P. G.
Hungary	Klement, Z.
Ireland	Walsh, P.
Italy	Bazzi, C.
Japan	Okuse, I.
Mexico	Fucikovsky, L.
Netherlands	Maas Geesteranus, H. P.
New Zealand	Young, J. M.
Norway	Roed, H.
Poland	Sobiczewski, P.
Portugal	Martins, J. M. S.
Romania	Severin, V.
Russia	Voronkova, L.
South Africa	Matthee, F. N.
Spain	Noval Alonso, C.
Sweden	Graberg, M.
Switzerland	Grimm, R.
Yugoslavia	Arsenijevic, M.

SUMMARY

Persons Interested in Fire Blight

Country	Interest Category 1	2	3	4	Total	Number of Contact Persons
* USA - United States	36	46		4	86	21
* CND - Canada	3	16			19	4
* BRD - West Germany	11	16	3		30	2
* NL - Netherlands	5	7			12	1
* FR - France	5	1	3		9	1
* BLG - Belgium	6	3			9	1
* UK - England	4	4			8	1
* DK - Denmark	1	5			6	1
* DDR - East Germany			3		3	1
* POL - Poland	1		1		2	1
* NZ - New Zealand		2			2	1
* MEX - Mexico		1			1	1
ITA - Italy			7		7	1
SPN - Spain			5		5	1
SWT - Switzerland			5		5	1
ARG - Argentina			3		3	1
CZE - Czechoslovakia			3		3	1
JAP - Japan			3		3	1
SA - South Africa			3		3	1
SWD - Sweden			3		3	1
AUS - Australia			2		2	1
YUG - Yugoslavia			2		2	1
GRC - Greece			2		2	1
HUN - Hungary			2		2	1
NOR - Norway			2		2	1
ROM - Romania			2		2	1
IRL - Ireland			1		1	1
POR - Portugal			1		1	1
CHI - China			1		1	1
RUS - Russia			1		1	1
OST - Austria			2		2	
BRA - Brazil			2		2	
IND - India			1		1	
MOR - Morocco			1		1	
PHI - Philippines			1		1	
TUR - Turkey			1		1	
TOTAL	72	101	66	4	243	54

*Countries with fire blight.

CUT

Fire Blight Mailing List Questionnaire

The list of names in this Newsletter is an annual attempt to establish a complete and updated mailing list of all persons interested in fire blight. Please make corrections and additions where necessary and send me any new names not listed. A new list will be prepared for the next newsletter.

☐ My name, address and telephone are correct (if not, show change below)

☐ My interest in fire blight is correct (if not, please indicate below)

☐ My name should be dropped from this list

☐ My/other name should be added to this list

NAME _____

ADDRESS _____

_____

_____ ZIP

TELEPHONE _____

Interest in fire blight research: 1 2 3 4

Interest in fire blight newsletter: YES NO

I will serve as contact person for newsletter questionnaire: YES NO

} Please circle one of each

_____

Please return to your contact person or directly to:

T. van der Zwet
Appalachian Fruit Research Station
Route 2, Box 45
Kearneysville, West Virginia 25430